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Yamasaki et al.

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(54) **BATTERY LOADING AND UNLOADING MECHANISM**

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Related U.S. Application Data

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(30) **Foreign Application Priority Data**

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Dec. 28, 2004 (JP) 2004-379985

(51) **Int. Cl.**
H01M 2/10 (2006.01)
H01M 2/34 (2006.01)
H01M 10/42 (2006.01)

(52) **U.S. Cl.**
CPC ***H01M 2/1061*** (2013.01); ***H01M 2/1022*** (2013.01); ***H01M 2/1066*** (2013.01); ***H01M 2/342*** (2013.01); *H01M 10/4221* (2013.01)

(58) **Field of Classification Search**
CPC H01M 2/1016; H01M 2/1022; H01M 2/1061
USPC 429/96, 97, 100, 163
See application file for complete search history.

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(74) *Attorney, Agent, or Firm* — Michael Best & Friedrich LLP

(57) **ABSTRACT**

Erroneous insertion of a battery into an imaging device is prevented. In a battery loading and unloading mechanism, a battery is formed with projecting portions at longitudinal both ends of a back surface and along back surface, the back surface being a surface opposite to an insertion surface of the battery, whereby even the battery formed in a flat rectangular parallelepiped and having the almost-square main surface can be prevented from being erroneously inserted into the device. The projecting portion has an inclined surface acutely inclined with respect to the back surface, and when the battery is unloaded from the device, unloading of the battery from the device is accelerated by the inclined surface undergoing contact pressure of the retaining means.

18 Claims, 13 Drawing Sheets

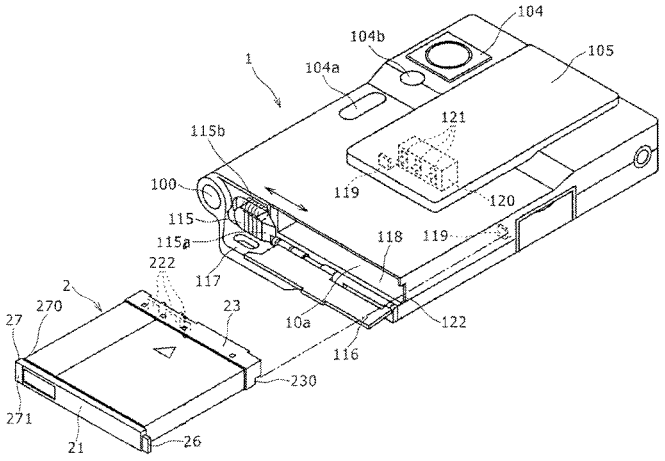

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FIG. 1A

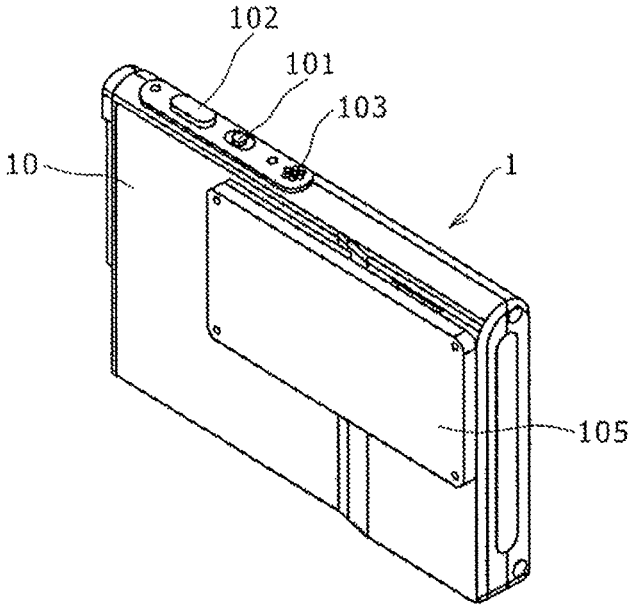
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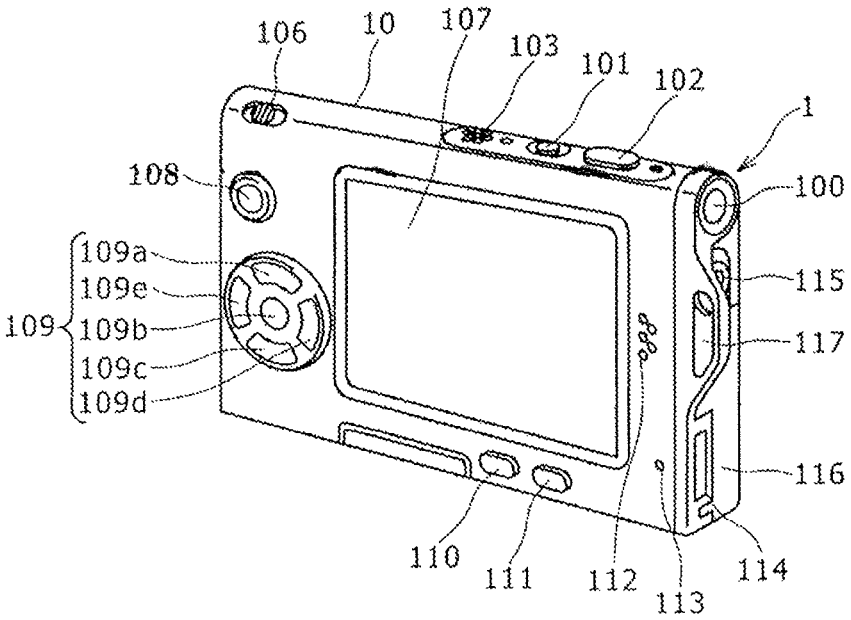
FIG. 1B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103
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109a
109e
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109b
109c
109d
115
117
116
110
111
112
113
114

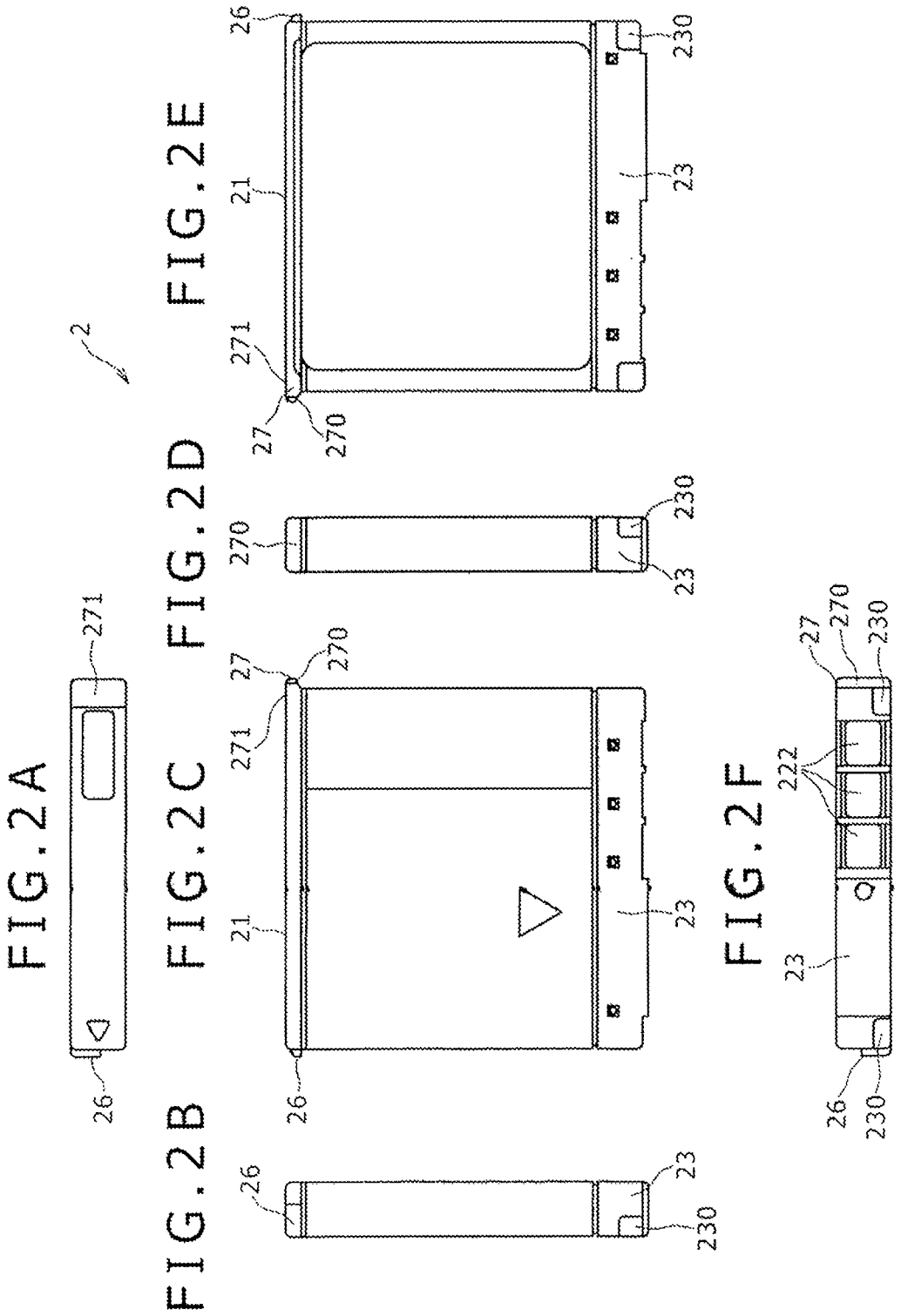
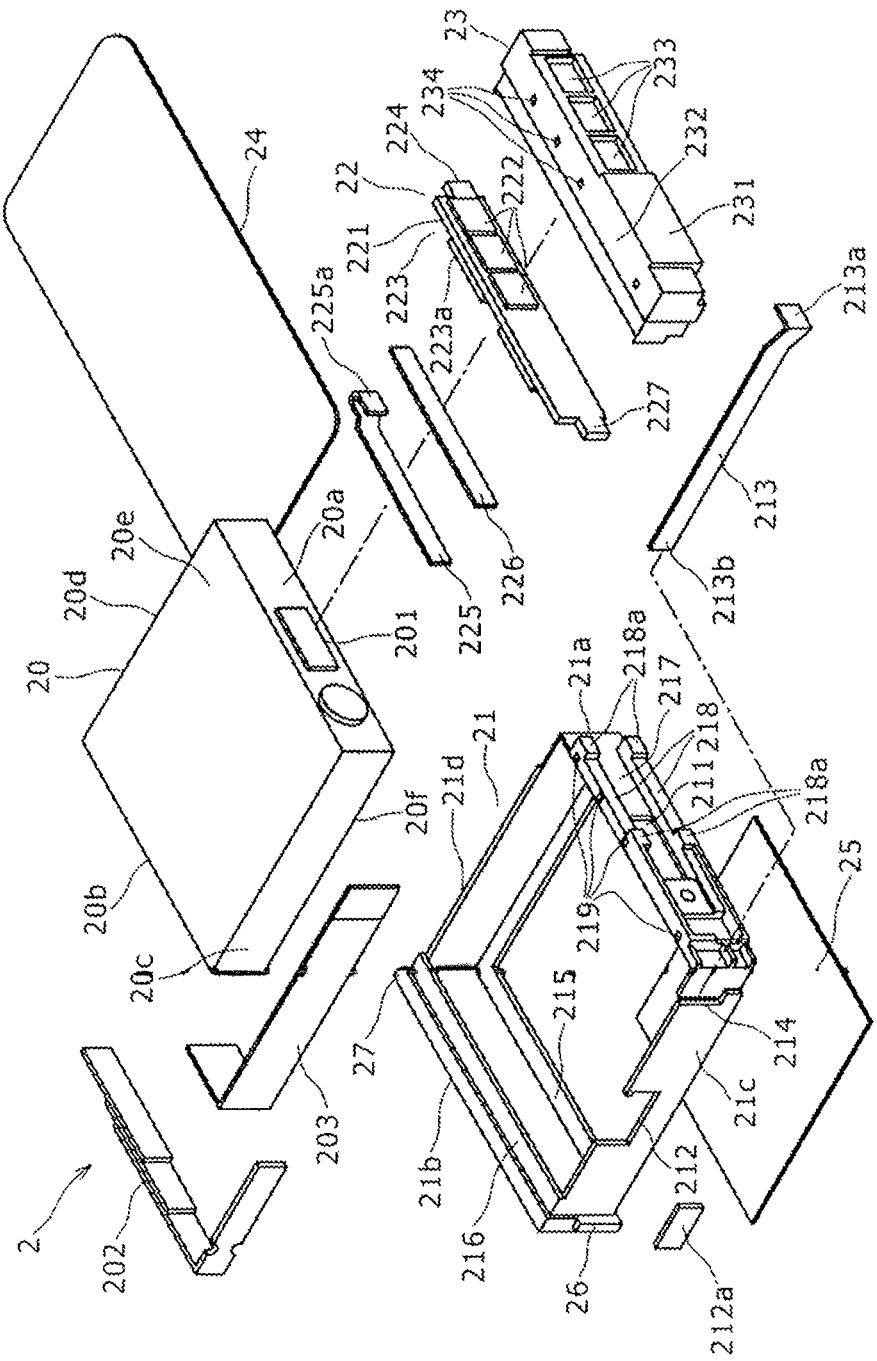

2
271
26
FIG. 2A
27
270
271
21
23
26
230
FIG. 2B
FIG. 2C
FIG. 2D
FIG. 2E
FIG. 2F
222

FIG. 3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212a
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213a
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218a
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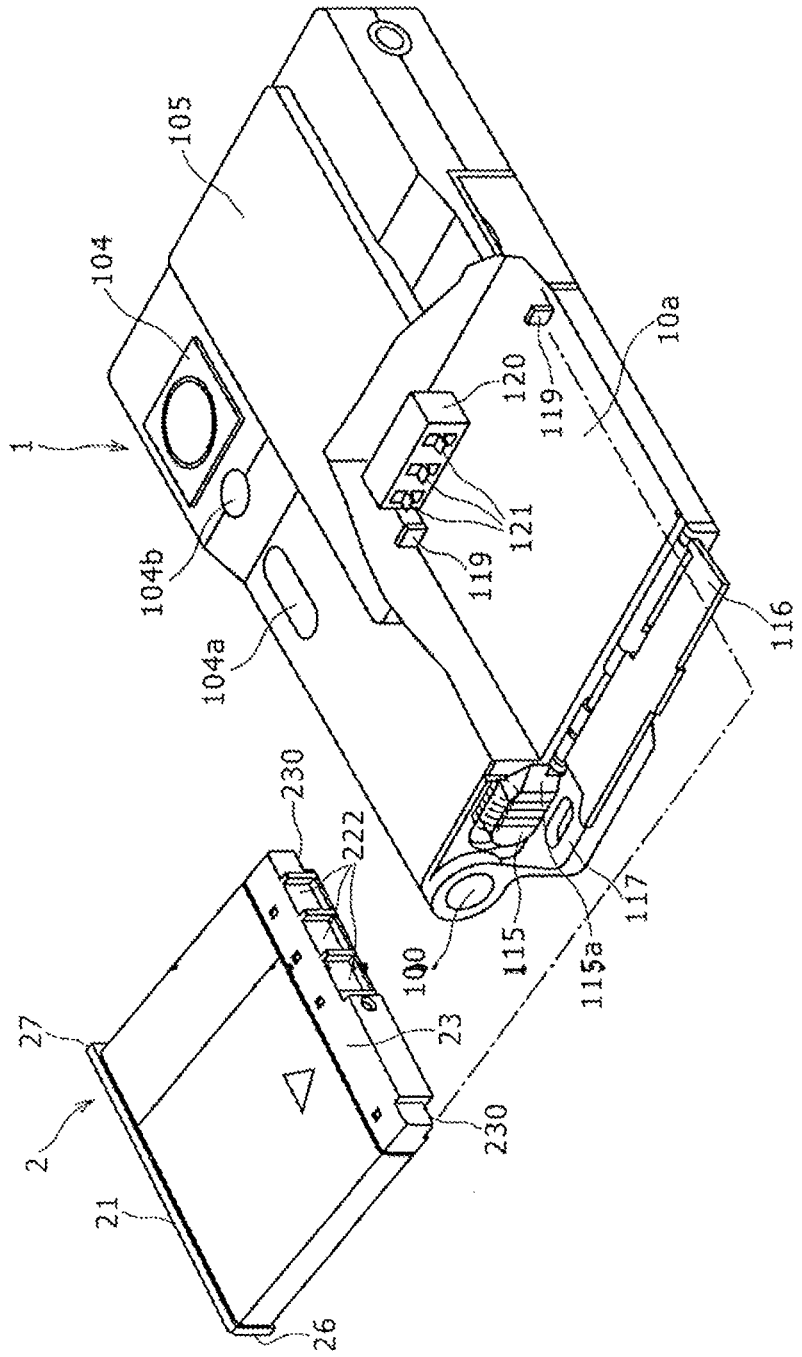
FIG. 4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104b
104a
120
119
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10a
116
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222
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115a
117
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26

FIG. 5

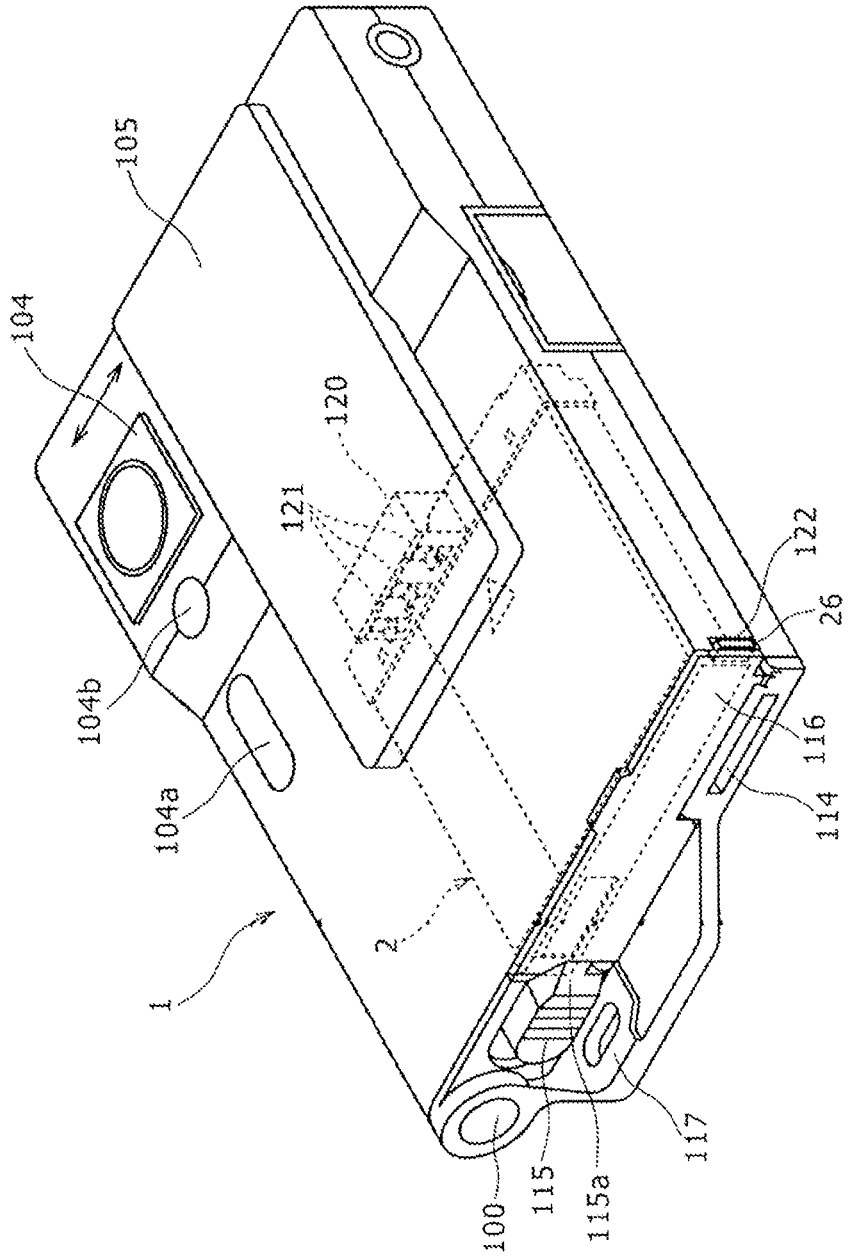
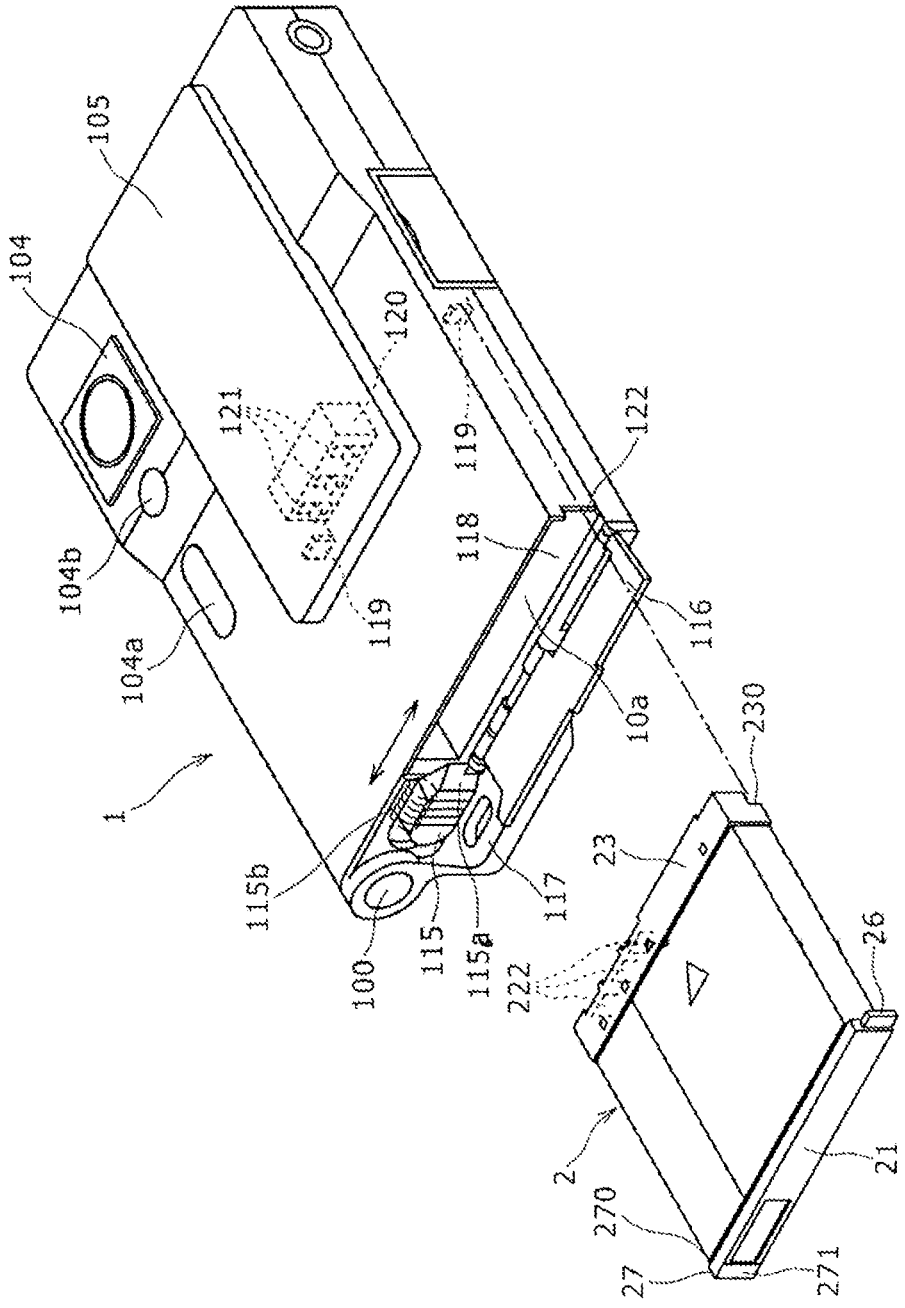


FIG. 6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115b
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271

FIG. 7A

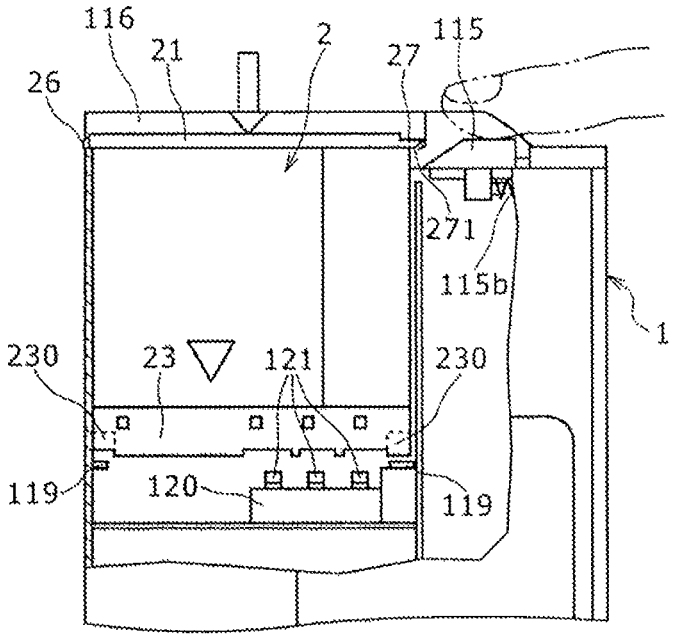


FIG. 7B

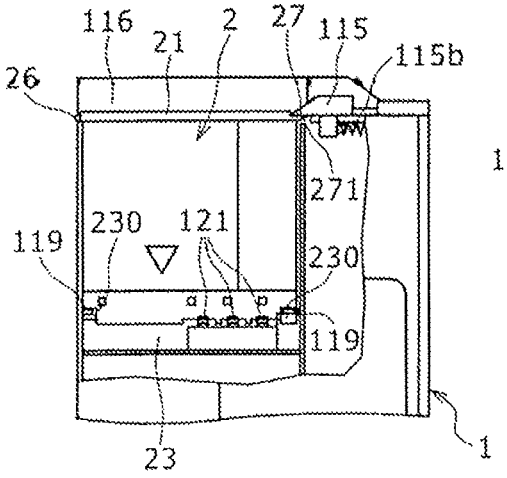


FIG. 7C

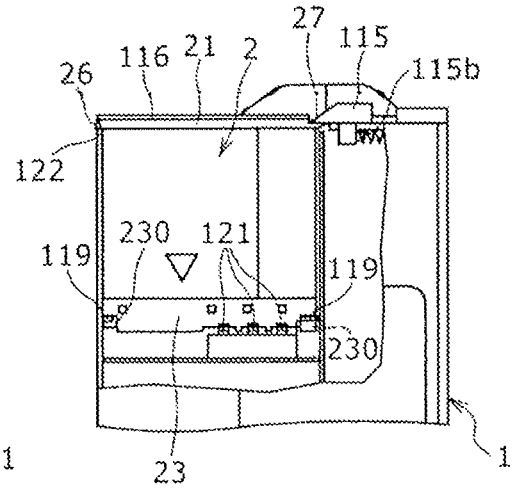


FIG. 8A

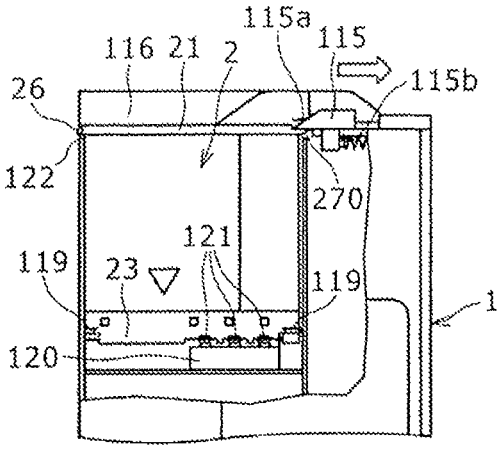


FIG. 8B

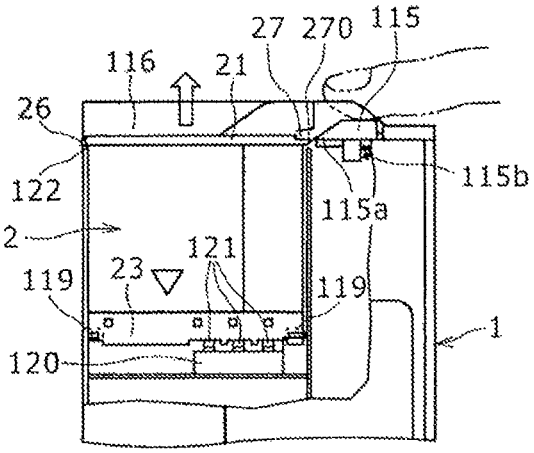


FIG. 8C

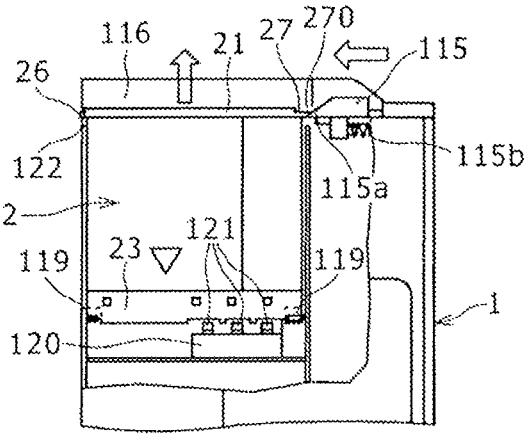


FIG. 9A

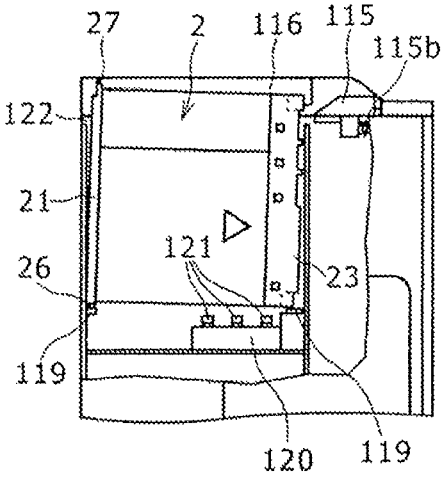


FIG. 9C

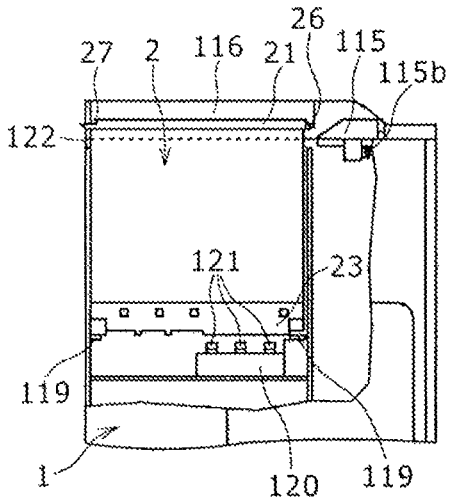


FIG. 9B

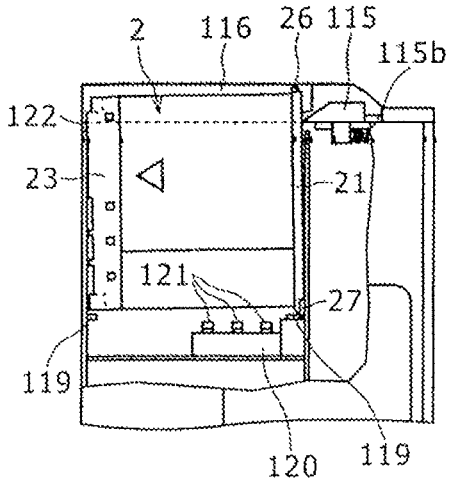
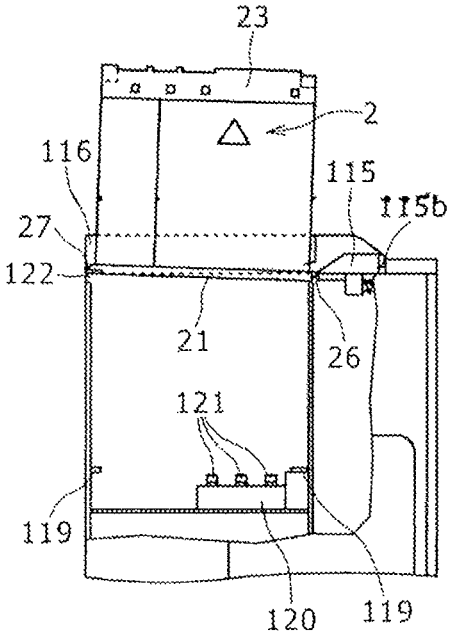


FIG. 9D



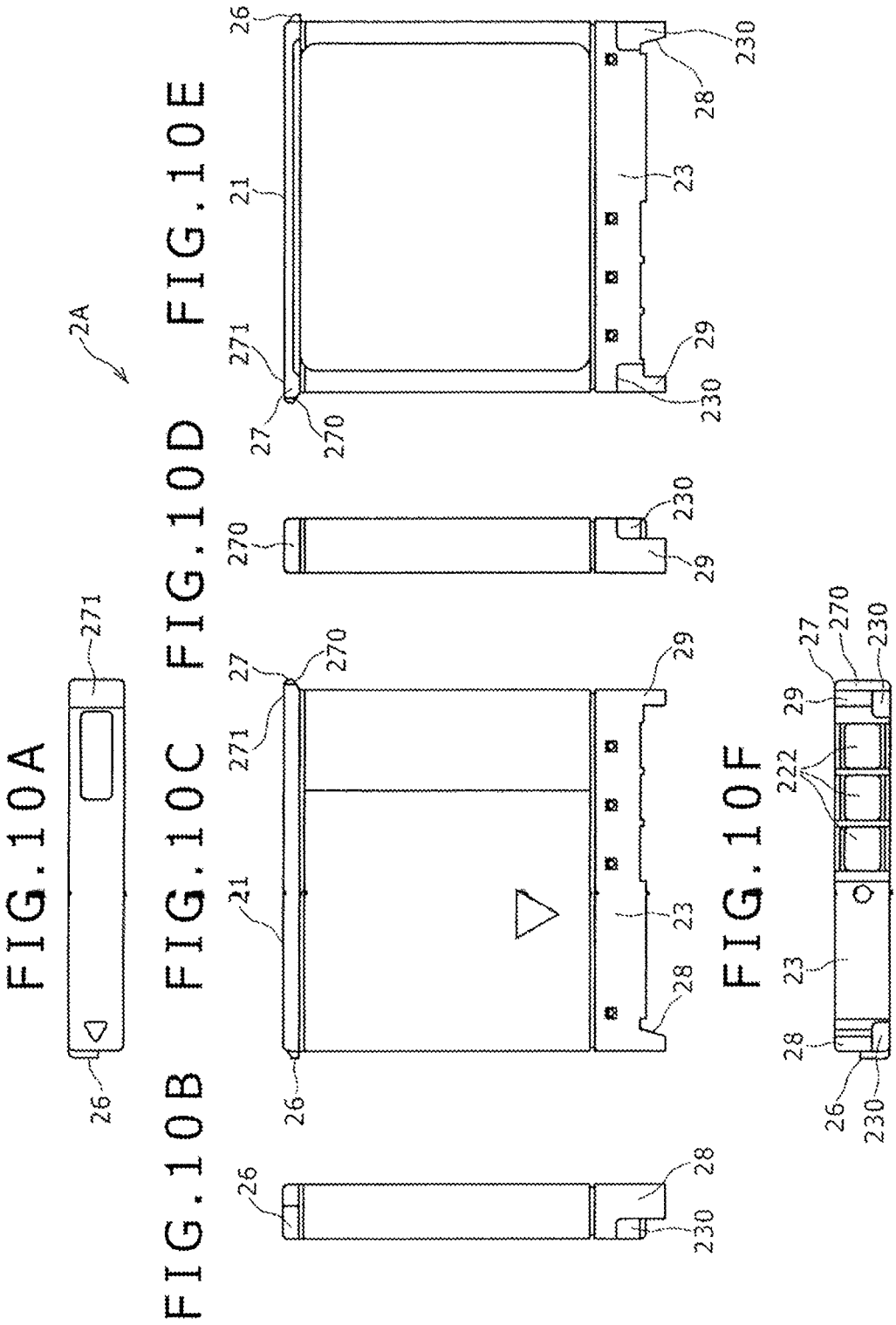

2A
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FIG.10A
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FIG.10B
FIG.10C
FIG.10D
FIG.10E
FIG.10F
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FIG. 11

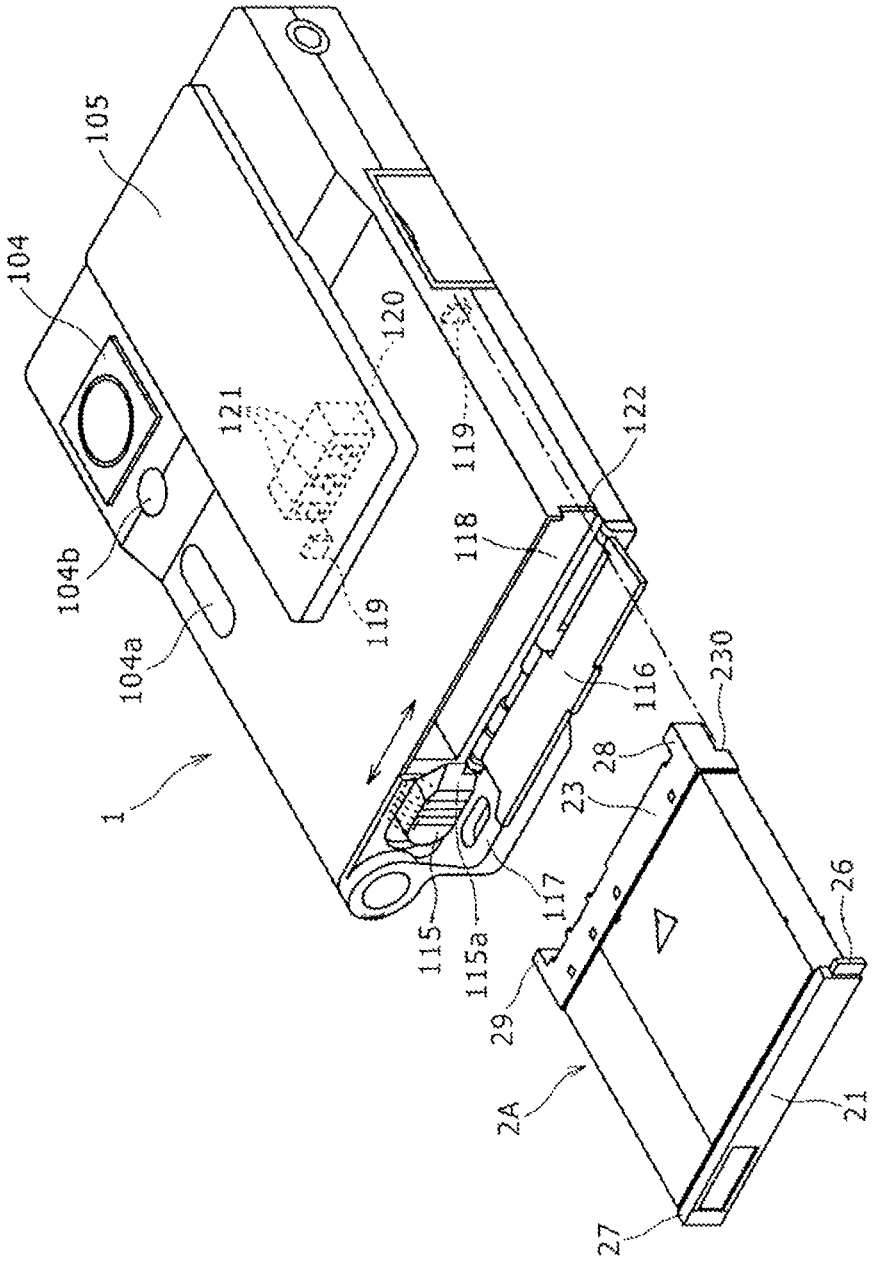
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FIG. 12A

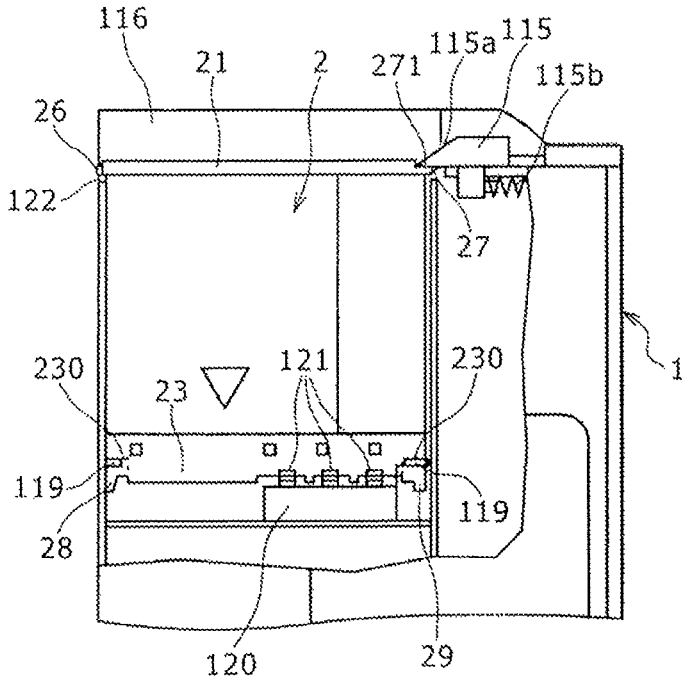


FIG. 12B

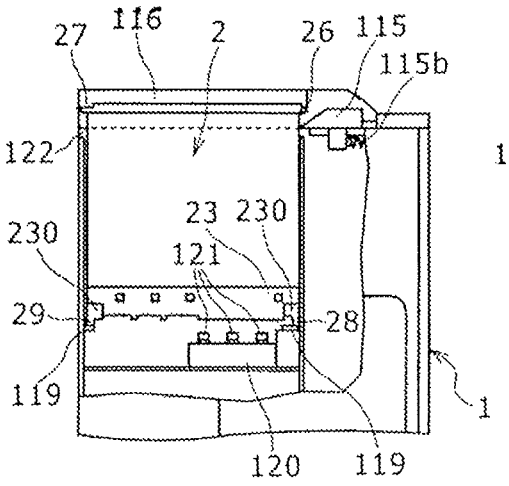


FIG. 12C

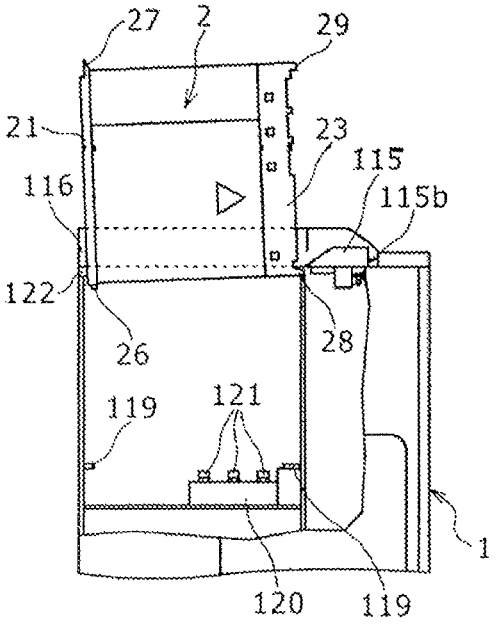


FIG. 13

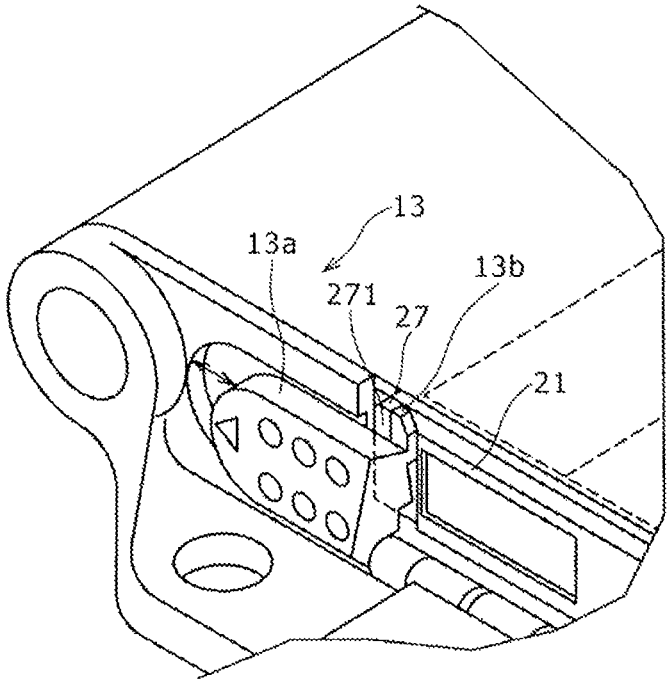
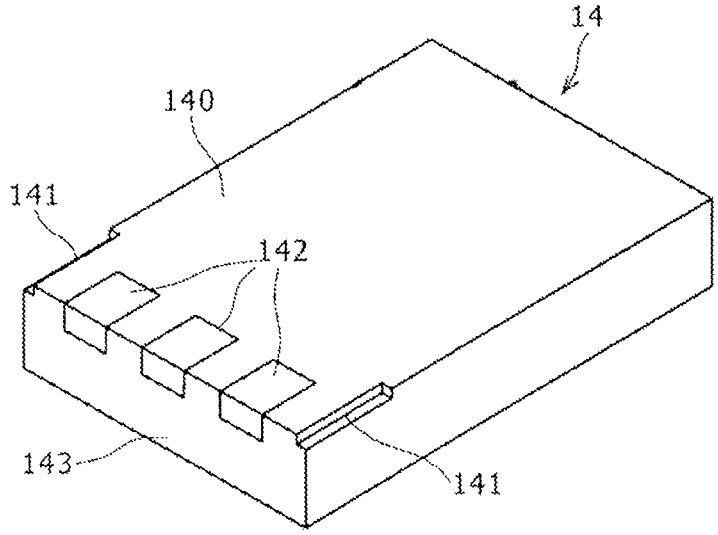


FIG. 14



BATTERY LOADING AND UNLOADING MECHANISM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. application Ser. No. 13/116,916, filed May 26, 2011, which is a division of U.S. application Ser. No. 11/722,917, filed Mar. 17, 2008, which is a §371 national stage filing of International Application No. PCT/JP05/023627, filed Dec. 22, 2005, claims the benefit of priority of Japanese Patent Application Nos. JP 2004-379984, filed Dec. 28, 2004, and JP 2004-379985, filed Dec. 28, 2004, the subject matter of each of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

The present invention relates to a mechanism for loading and unloading a battery attached removably to a device which needs the battery.

BACKGROUND ART

As imaging devices represented by digital cameras have recently been reduced in size and weight, batteries loaded in the imaging devices have been formed in a rectangular parallelepiped advantageous in downsizing and weight saving. Imaging devices employing a battery need to be formed from a rigid member that withstands bending moment in order to prevent erroneous insertion of the battery or damage to the imaging device. This hinders the downsizing and weight saving.

To solve the problem, Japanese Patent Laid-open No. 2003-317689 shows a battery **14** as depicted in FIG. **14**. This battery **14** is formed in a rectangular parallelepiped in which the length of an insertion-wise side is greater than that of a widthwise side to prevent erroneous insertion into an imaging device. In addition, an exterior package **140** of the battery is formed with notched portions **141** on its sides, which reliably prevents erroneous insertion and facilitates further downsizing and weight saving of imaging devices or the like attached with the battery **14**. The exterior package **140** is provided with terminals **142** connected electrically to terminals of an imaging device attached with the battery **14**. The number and positions of the notched portions **141** to be formed are determined so that an end face **143** is asymmetrical. On the other hand, a battery holder in the imaging device adapted to house the battery **14** therein has almost the same inner shape as the outer shape of the exterior package **14**. In addition, the battery holder is formed with projections each of which engages a corresponding one of the notched portions **141**, **141** when the battery holder is housed therein. Incidentally, Japanese Patent Laid-open Nos. Hei 11-307072, 2001-76700 and Hei 11-3692 disclose batteries of the same type as that disclosed in Japanese Patent Laid-open No. 2003-317689.

It has recently been requested to reduce the size and weight of devices such as imaging devices equipped removably with a battery, which has need to further downsize batteries. To further downsize the rectangular parallelepipedic battery, it is only needed to form the battery to have almost-square opposite surfaces. However, past batteries have no projections on lateral surfaces and the devices mentioned above have not clear retaining portions for retaining the battery received therein. For this reason, the users have not grasped the positional relationship between the battery and the retaining portions, leading to the high probability that the users erroneously insert the battery into the device mentioned above.

It is assumed that a battery is formed to have almost square surfaces and the respective terminal contacts of the battery and an imaging device are off-center. In this case, even if the battery is inserted upside down or laterally-erroneously inserted into the device, the terminals of the battery do not contact those of the device, that is, the battery does not electrically contact the device. However, a battery casing is liable to contact and damage the terminals of the device.

In view of the forgoing, the invention has been made and it is an aim of the present invention to provide a battery loading and unloading mechanism that can prevent erroneous insertion of a battery into a device resulting from downsizing of the battery attached removably to the device.

DISCLOSURE OF THE INVENTION

A battery loading and unloading mechanism according to the present invention is a mechanism for loading and unloading a flat almost-rectangular parallelepipedic battery to and from a device to be detachably equipped with the battery, and is distinctive in that the battery is formed with projecting portions at longitudinal both ends of a back surface thereof and along the back surface, the back surface being a surface opposite to an insertion surface of the battery inserted into the device, whereby even the battery formed in a flat rectangular parallelepiped and having the almost-square main surface can be prevented from being erroneously inserted into the device.

The battery loading and unloading mechanism of the present invention is distinctive in that the device includes retaining means for retaining the battery, one of the projecting portions of the battery has a to-be-retained surface retained by the retaining means, the to-be-retained surface is set to a level lower than the back surface, whereby a portion retained by the retaining means is made clear.

The battery loading and unloading mechanism of the present invention is distinctive in that the to-be-retained surface is a surface having a frictional coefficient smaller than that of a portion of the back surface other than the to-be-retained surface, whereby the portion to be retained is made clearer and can be more quickly retained.

The battery loading and unloading mechanism of the present invention is distinctive in that the projecting portion having the to-be-retained surface has an inclined surface acutely inclined with respect to the back surface, and when the battery is unloaded from the device, unloading of the battery from the device is accelerated by the inclined surface undergoing contact pressure of the retaining means.

The battery loading and unloading mechanism of the present invention is distinctive in that the device is formed with a notched portion which is adapted to receive and expose the other projecting portion of the battery at the time of loading the battery, thereby facilitating unloading of the battery.

The battery loading and unloading mechanism of the present invention is distinctive in that the battery is formed with projecting portions projecting in an inserting direction at both end portions of the insertion surface, thereby preventing damage to the battery and to a terminal of the device when the battery is erroneously inserted.

The battery may have an almost square main surface.

The battery loading and unloading mechanism of the present invention described above can make clear a method of loading and unloading a battery to and from a device to be detachably equipped with the battery, whereby erroneous insertion of the battery into the device can be prevented.

Even the battery having an almost square main surface can be prevented from being erroneously inserted. In addition, the battery and the terminal of a device attached with the battery can be protected, this device can be downsized, and mounting flexibility can be enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1**A and **1**B include schematic views depicting an embodiment of an imaging device attached with a battery of the present invention, in particular, FIG. **1**A is a schematic view depicting the front of the imaging device, and FIG. **1**B is a schematic view depicting the back of the imaging device.

FIGS. **2**A-**2**F include schematic views depicting an embodiment of the battery to be attached to the imaging device, and in particular, FIG. **2**A through **2**F are schematic views depicting the lateral surfaces of the battery according to the embodiment.

FIG. **3** is an exploded perspective view of the battery.

FIG. **4** is a schematic view depicting the inside of the imaging device housing the battery therein.

FIG. **5** is a schematic view of the imaging device attached with the battery.

FIG. **6** is a view for assistance in explaining a procedure for inserting the battery into the imaging device.

FIGS. **7**A-**7**C include views for assistance in explaining inserting operation of the battery.

FIGS. **8**A-**8**C include views for assistance in explaining discharging operation of the battery.

FIGS. **9**A-**9**D include views for assistance in explaining operation for preventing erroneous insertion of the battery.

FIGS. **10**A-**10**F include schematic views depicting an embodiment of a battery attached to an imaging device, and in particular, FIG. **10**A through **10**F are schematic views depicting lateral surfaces of the battery according to the embodiment.

FIG. **11** is a view for assistance in explaining a procedure for inserting the battery into the imaging device.

FIG. **12**A is a view for assistance in explaining operation for inserting the battery and FIGS. **12**B and **12**C are views for assistance in explaining operation for preventing erroneous insertion of the battery.

FIG. **13** is a schematic view depicting an embodiment of a locking claw.

FIG. **14** is a schematic view depicting an existing battery.

BEST MODE FOR CARRYING OUT THE INVENTION

Embodiments of the present invention will be hereinafter described with reference to the drawings.

FIG. **1** includes schematic views depicting an embodiment of an imaging device attached with a battery of the present invention, in particular, FIG. **1**A is a schematic view depicting the front of the imaging device, and FIG. **1**B is a schematic view depicting the back of the imaging device. FIG. **2** includes schematic views depicting an embodiment of the battery to be attached to the imaging device, and in particular, FIG. **1**A through **1**F are schematic views depicting the side surfaces of the battery according to the embodiment. FIG. **3** is an exploded perspective view of the battery. FIG. **4** is a schematic view depicting the inside of the imaging device housing the battery therein. FIG. **5** is a schematic view of the imaging device attached with the battery. FIG. **6** is a view for assistance in explaining a procedure for inserting the battery into the imaging device.

Referring to FIG. **1**A, the imaging device **1** includes a zoom lever **101**, a shutter button **102** and a microphone **103** located on an upper surface portion of a main body **10**. In addition, referring to FIG. **4**, the imaging device **1** includes an imaging lens **104**, a flash **104***a*, an AF illuminator **104***b* and a lens cover **105** located on a front portion of the main body **10**. The lens cover **105** slidably covers the imaging lens **104**, the flash **104***a* and the AF illuminator **104***b*. The AF illuminator **104***b* emits auxiliary light for focusing in a dark place.

Referring to FIG. **1**B, the imaging device **1** includes a mode selection switch **106**, a monitor **107**, a menu button **108**, a control button **109**, a screen display button **110**, a screen size selection/screen-erasing button **111**, a speaker **112** and a reset button **113** located on the back portion of the main body **10**. The control button **109** consists of a flash button **109***a*, a review button **109***b*, a self timer button **109***c*, a macro button **109***d* and a decision button **109***e*. These constituent elements may adopt those equipped in a known digital camera (e.g., a digital camera DSC-T3 manufactured by Sony Corporation).

The imaging device **1** includes a housing portion **10***a* for housing the battery **2** as shown in FIG. **4**. Referring to FIG. **5**, the imaging device **1** includes, on a lateral surface portion on a battery insertion side, a power button **100**, a multi-terminal **114**, a locking claw **115** serving as means for retaining the battery **2** when the battery **2** is inserted and attached inside the imaging device **1**, a lid **116** serving as means for sealing the battery **2** attached, a strap lug **117** used to hold the imaging device **1** and an opening portion **118** (FIG. **6**) adapted to receive the battery **2**. Incidentally, the strap lug **117** also serves to facilitate holding the digital camera by placing a thumb thereon.

The housing portion **10***a* is provided with ribs **119** and a terminal plate **120**. The terminal plate **120** has spring-elastic terminals **121**. The ribs **119** come into contact with respective recessed portions **230** (FIG. **2**) formed in the battery **2** when the battery **2** is housed in the housing portion **10***a*. The terminals **121** are electrically connected to respective terminal contact portions **222** (FIG. **2**) of the battery **2** when the battery **2** is housed in the housing portion **10***a*.

The locking claw **115** is provided movably in arrow directions of FIG. **6** and biased in the direction of the opening portion **118** by a spring **115***b* shown in FIG. **7**. The locking claw **115** shown in the figure is formed with an inclined surface **115***a*. The inclined surface **115***a* serves to compensate for the discharged amount of the battery **2**. More specifically, when the battery **2** is unloaded from the imaging device **1**, the locking claw **115** pressed by the contact pressure of the spring **115***b* slides under a projecting portion **27** formed on a frame portion **21** of the battery **2** with the aid of the inclined surface **115***a*, thereby accelerating the discharge of the battery **2**. It should be noted that the locking claw **115** needs only to retain the battery attached to the imaging device **1**; therefore, it is not necessarily formed with the inclined surface **115***a*, that is, the locking claw may be formed as shown in FIG. **13**. A locking claw **13** is provided with a retaining portion **13***a* which is movable in a reciprocative manner by elastic deformation of a spring having the same configuration as the spring **115***b*. The retaining portion **13***a* is further provided with an auxiliary retaining portion **13***b*.

Referring to FIG. **3**, the battery **2** includes a battery cell **20** having an almost-square main surface; a rectangular frame portion **21** housing the battery cell **20** therein; and a circuit board portion **22** disposed on the external surface of the frame portion **21**. The battery **2** further includes a cap portion **23** which is attached to one end side of the frame portion **21** and the battery cell **20** so as to put the circuit board portion **22** between the external surface of the frame portion **21** and the

cap portion **23**; and an external package film **24** integrally covering the battery cell **20** and the frame portion **21**.

The battery cell **20** is formed by covering a laminated body (a battery element) with a film-like external package member. The laminated body is formed by sequentially laminating, for example, a positive pole piece, a separator, a negative pole piece and the like. Referring to FIG. **2**, the battery cell **20** is formed in a flat almost-rectangular parallelepiped by a first through fourth lateral surfaces **20***a* to **20***d*, and front and rear surfaces **20***e*, **20***f*. The battery cell **20** is projectingly formed with a cell positive electrode portion **201** at an almost central portion of the first lateral surface **20***a*. In addition, the battery cell **20** is formed with a cell negative electrode portion (not shown) at a central portion of the second lateral surface **20***b* on the opposite side of the first lateral surface **20***a*. One end of a positive temperature coefficient thermistor (hereinafter, referred to as the PTC tab) **202** is connected to the cell negative electrode portion. The PTC tab **202** acts as a safety component adapted to establish non-conduction at the time of high temperature. The other end of the PTC tab **202** terminates at the third lateral surface **20***c* of the battery cell **20**. An insulating paper **203** is interposed between the third lateral surface **20***c* of the battery cell **20** and the PTC tab **202**.

The frame portion **21** is made of an electrically insulating synthetic resin and formed like a quadrate frame. The first through fourth sides **21***a* to **21***d* of the frame portion **21** are respectively superposed on the external surfaces of the first through fourth lateral surfaces **20***a* through **20***d* of the battery cell **20**.

The first side **21***a* of the frame portion **21** superposed on the first lateral face **20***a* of the battery cell **20** is formed with a cell positive electrode portion fitting window **211**. The cell positive electrode portion fitting window **211** is adapted to receive the cell positive electrode portion **201** fitted thereinto. The third side **21***c* superposed on the third lateral surface **20***c* of the battery cell **20** is formed with a notched portion **212** that an end of the PTC tab **202** faces. In addition, the third side **21***c* is formed with a slit **214**, at the end thereof close to the first side **21***a*, adapted to introduce a negative electrode tab **213** inside the third side **21***c*. A spacer **212***a* is attached to the notched portion **212**.

The frame portion **21** is formed at its bottom portion with a flange-like projection **215** adapted to support the bottom of the battery cell **20**. In addition, the frame portion **21** is formed at its upper portion with a flange-like projection **216** which extends along the upper edge of the second side **21***b* and faces the flange-like projection **215**. An end portion of the battery cell **20** on the side of the second lateral surface **20***b* of the battery cell **20** is gripped between the projections **215**, **216**.

The height of the second side **21***b* of the frame portion **21** is set equal to the height (thickness) of the housed battery cell **20** encountered at the time of charging or of most expansion resulting from high temperatures.

The first side **21***a* of the frame portion **21** is provided with a circuit board attachment portion **217** on its external surface. The circuit board attachment portion **217** is formed between a pair of upper and lower cap support portions **218** which is projectingly formed at upper and lower ends, respectively, of the external surface of the first side **21***a* included in the frame portion **21**. The cap support portion **218** is provided with a plurality of cap portion retaining claws **219**.

The circuit board portion **22** includes a base plate **221**, a plurality of terminal contact sections **222**, electronic components and a transfer mold **223**. The base plate **221** is formed of an insulative synthetic resin such as glass epoxy phenol, etc. The terminal contact sections **222** are attached to the external surface side of the base plate **221**. The electronic components and the transfer mold **223** which molds the electronic components therein are attached to the interior surface side of the base plate **221**. The circuit board portion **22** is fixedly assembled and put between the frame portion **21** and the cap portion **23** with a preset (slight) gap defined between a leading end of the transfer mold **223** and the frame portion **21**.

One end portion **225***a* of a positive electrode tab **225** is joined by welding to a terminal portion **224** formed at one end of the circuit board portion **22**. The other end of the positive electrode tab **225** is joined to the cell positive electrode portion **201** by welding. An insulating paper **226** is interposed between the circuit board portion **22** and the positive electrode tab **225**. One end **213***a* of the negative electrode tab **213** is joined to a terminal portion **227** formed at the other end of the circuit board **22** by welding.

The positive electrode tab **225** is made of a metal plate such as a nickel plate, etc. and formed like an almost-L shape. The metal plate is subjected to the so-called annealing to facilitate bending. The almost-L shaped positive electrode tab **225** has a long side connected to the positive electrode tab **225** and a short side connected to the terminal portion **227** formed at the one end of the circuit board portion **22**.

Similarly, the negative electrode tab **213** is made of a metal plate such as a nickel plate, etc. and formed like an almost-L shape. The almost-L shaped negative electrode tab **213** has one end **213***a*, formed at its short side, connected to the terminal portion **227** formed at the other end of the circuit board portion **22**. In addition, the negative electrode tab **213** has the other end **213***b*, formed at its long side, which is led to the inner surface side of the frame portion **21** via a slit **214** formed in the third side **21***c* of the frame portion **21** and is connected to the PTC tab **202**.

The cap portion **23** includes a rectangular end face portion **231** and a tubular portion **232**. The end face portion **231** is superposed on the external surface of the first side **21***a* of the frame portion **21** via the circuit board portion **22** (with the circuit board portion **22** sandwiched between the end face portion **231** and the external surface of the first side **21***a*) attached to the circuit board portion attachment portion **217**. The tubular portion **232** is contiguous to the end face portion **231** and is fitted to the one end side of the frame portion **21** and the battery cell **20**.

The end face portion **231** of the cap portion **23** is formed with a plurality of terminal windows **233** that the terminal contact portions **222** of the circuit board portion **22** face. The tubular portion **232** is formed with a plurality of claw engaging holes **234** in the upper and lower surface thereof. The claw engaging holes **234** are each engaged with a corresponding one of the cap portion retaining claws **219** provided on the pair of upper and lower cap portion support portion **218** of the frame portion **21**.

As shown in FIG. **3**, the pair of upper and lower cap support portions **218** of the frame portion **21** are provided with a plurality of projections **218***a* projecting toward the circuit board portion **22**. The projections **218***a* come into abutment against the circuit board portion **22** at positions where the transfer mold **223** is sandwiched between the circuit board portion **22** and the projections **218***a* and at portions on which the electronic components are not mounted, when the terminal contact portion **222** of the circuit board portion **22** is pressurized by the counterpart terminals.

The external package film **24** is made of a synthetic resin such as polyethylene (PE), polyethylene terephthalate (PET), polycarbonate (PC), etc. and formed into a sheet having a thickness of about 0.05 to 0.1 mm. The battery cell **20** is housed in the frame portion **21**, the circuit board portion **22** and the like are attached to the frame portion **21**, and the cap

portion **23** is covered thereon. Thereafter, the external package film **24** is wound around the frame portion **21** to cover the front and back surfaces of the battery cell **20** and integrally unites the battery cell **20**, the frame portion **21** and the cap portion **23**. Incidentally, a model plate film **25** is attached to the external package film **24**.

The frame portion **21** is formed on the edge portions of the second side **21***b* with projecting portions **26**, **27** which extend in the length direction of the side. This makes it possible to prevent the erroneous insertion of the battery **2** into the imaging device **1**.

As shown in FIG. **2**, the projecting portion **26** is formed in an almost rectangular parallelepiped. The imaging device **1** is formed on its lateral surface with a notched portion **122** which is adapted to receive the projecting portion **26** exposed to the outside when the battery **2** is loaded on the imaging device **1**. The notched area of the notched portion **122** is set equal to or greater than the installation area of the projecting portion **26** relative to the frame portion **21** of the battery **2**.

As shown in FIG. **2**, the projecting portion **27** is formed in an almost trapezoid in cross-section to have an inclined surface **270**. In addition, the projecting portion **27** is formed with a to-be-retained surface **271** which is retained by the locking claw **115** when the battery **2** is loaded on the imaging device **1** and the locking claw **115** retains the battery **2**.

Setting the height of the to-be-retained surface **271** at a level lower than the surface of the frame portion **21** makes clear the portion retained by the locking claw **115**. In addition, the locking claw **115** undergoing the contact pressure of the spring **115***b* can be restrained. The to-be-retained surface **271** has a smaller frictional coefficient than the peripheries of the to-be-retained surface **271**. This makes clearer the portion to be retained. Further, the locking claw **115** becomes slipperier; therefore, it is restrained quickly.

Inserting operation of the battery **2** is described with reference to FIGS. **6** to **9**.

As shown in FIG. **6**, the battery **2** is inserted into the imaging device **1** with the surface of the battery **2** having the terminal contact sections **222** facing the opening portion **118** of the imaging device **1**. At this time, as shown in FIG. **7**A, the battery **2** is inserted into the imaging device **1** with the locking claw **115** pulled with a finger. As shown in FIG. **7**B, the bottoms of the recessed portions **230** of the battery **2** come into contact with the ribs **119** in the imaging device **1** and the battery **2** is fitted into the imaging device **1**. At this time, the locking claw **115** is released from the finger, being slid on the to-be-retained surface **271** in the direction of the battery **2** by the contact pressure of the spring **115***b*, and retains the to-be-retained surface **271**, thereby retaining the battery **2**. Thereafter, as shown in FIG. **7**C, the lid **116** is closed to seal the battery **2** in the imaging device **1**. At this time, the terminals **121** provided on the terminal plate **120** of the imaging device **1** are each brought into electrical connection with a corresponding one of the terminal contact portions **222** of the battery **2** while being compressed resulting from elastic deformation.

Next, when the battery **2** is to be removed, as shown in FIG. **8**A, the locking claw **115** is pulled with a finger (not shown) in a direction of lateral arrow. As a result, as shown in FIG. **8**B, the battery **2** undergoes the contact pressure of the terminals **121** on the terminal plate **120** to project in the direction of arrow. When released from the finger, the locking claw **115** is biased by the spring **115***b* urging it in the direction of the opening portion **118** (FIG. **6**) to move in the direction of lateral arrow as shown in FIG. **8**C. At this time, since the projecting portion **26** of the battery **2** is exposed to the outside of the imaging device **1**, the battery **2** can be easily taken out by placing fingers on the projecting portions **26**, **27**. If the locking claw **115** is formed with the inclined surface **115***a*, the locking claw **115** is slid under the projecting portion **27** while the inclined surface **115***a* is brought into contact with the inclined surface **270** of the projecting portion **27**. Thus, the discharged amount of the battery **2** can be compensated for so that the battery **2** further projects. This makes it possible to take out the battery **2** further easily.

On the other hand, as shown in FIGS. **9**A and **9**B, if the battery is laterally erroneously inserted into the imaging device **1**, the projecting portion **26** meets one of the ribs **119** and the lateral surface of the cap portion **23** meets the other rib **119**. In this case, since a portion of the battery **2** protrudes from the main body of the imaging device **1**, the locking claw **115** cannot retain the battery **2** and the lid **116** cannot close the opening portion **118**.

As shown in FIG. **9**C, if the battery **2** is inserted into the imaging device **1** upside down, the ends of the cap portion **23** of the battery **2** meet the ribs **119**. Also in this case, since a portion of the battery **2** protrudes from the main body of the imaging device **1**, the locking claw **115** cannot retain the battery **2** and the lid **116** cannot close the opening portion **118**.

As shown in FIG. **9**D, if the battery **2** is inserted into the imaging device **1** in a back-to-front manner, the projecting portions **26**, **27** of the battery **2** meet the edge of the opening **118** of the imaging device **1** so that the battery **2** cannot be inserted into the imaging device **1**. Consequently, the locking claw **115** cannot retain the battery **2** and the lid **116** cannot close the opening portion **118**.

As described above, the battery **2** is prevented from being erroneously inserted into the imaging device **1**, so that any damage to the terminals **121** of the imaging device **1** resulting from erroneous insertion of the battery **2** can be avoided.

A battery **2**A according to an embodiment shown in FIG. **10** may be formed at both ends of a cap portion **23** with projecting portions **28**, **29** which project in the direction of insertion and differ from each other in shape. This can prevent erroneous insertion of the battery **2**A into the imaging device **1**. The projecting portion **28** is formed almost trapezoid in cross-section and the projecting portion **29** is formed in an almost rectangular parallelepiped.

The inserting operation of the battery **2**A is described with reference to FIGS. **11** and **12**.

As shown in FIG. **11**, with the locking claw **115** pulled with a finger in the direction of arrow, the battery **2**A is inserted into the imaging device **1** while the surface of the battery **2**A having the terminal windows **233** faces the opening portion **118** of the imaging device **1**. As shown in FIG. **12**A, the bottoms of the recessed portions **230** of the battery **2**A come into contact with the ribs **119** in the imaging device **1** and the battery **2** is fitted into the imaging device **1**. At this time, the locking claw **115** is released from the finger, being slid on the to-be-retained surface **271** in the direction of the battery **2**A by the contact pressure of the spring **115***b*, and retains the to-be-retained surface **271**, thereby retaining the battery **2**A. Thereafter, the lid **116** is closed to seal the battery **2**A in the imaging device **1**. At this time, the terminals **121** provided on the terminal plate **120** of the imaging device **1** are each brought into electrical connection with a corresponding one of terminal contact portions **222** of the battery **2**A while being compressed resulting from elastic deformation.

As shown in FIG. **12**B, if the battery **2**A is inserted into the imaging device **1** upside down, each of the projecting portions **28**, **29** of the battery **2**A meets a corresponding one of the ribs **119**. In this case, since a portion of the battery **2**A protrudes from the main body of the imaging device **1**, the locking claw **115** cannot retain the battery **2**A and the lid **116** cannot close

the opening portion **118**. In addition, the distance between the cap portion **23** of the battery **2**A and the ribs **119** of the imaging device **1** is maintained to an extent that both do not come into contact with each other.

As shown in FIG. **12**C, if the battery **2**A is laterally erroneously inserted into the imaging device **1**, the projecting portion **26** of the battery **2**A meets the lip of the opening **118** of the imaging device **1** so that the battery **2**A cannot be inserted into the imaging device **1**. The locking claw **115** cannot retain the battery **2** and the lid **116** cannot close the opening portion **118**.

As described above, the battery **2**A can be prevented from being erroneously inserted into the imaging device **1**, so that any damage to the terminals **121** of the imaging device **1** resulting from the erroneous insertion of the battery can be avoided.

Like the batteries **2**, **2**A, even a battery having an almost square main surface can be prevented from being erroneously inserted. In addition, the battery and the terminal of a device attached with the battery can be protected, this device can be downsized, and mounting flexibility can be enhanced.

The batteries **2**, **2**A described in the above embodiments are applied to the imaging device **1**. However, application of the battery according to the present invention is not limited to imaging devices and the battery can be applied to devices which need a battery, other than the imaging device.

The invention claimed is:

1. A battery comprising:
- a first surface;
- a frame portion disposed on the battery opposite to the first surface;
- a first side surface at a first side of the battery, the first side being substantially perpendicular to the first surface;
- a second side surface at a second side of the battery, the second side being substantially perpendicular to the first surface and being opposite to the first side; and
  - a first projecting portion and a second projecting portion,
  - the first projecting portion being located on a first side of the frame portion,
  - the second projecting portion being located on a second side of the frame portion, and
  - the first and second projecting portions disposed within a thickness of the frame portion in a direction perpendicular to the first surface,
  - wherein the first and second projecting portions have different shapes from one another and are substantially located at both longitudinal ends of the frame portion.

2. The battery according to claim **1**, wherein the first projecting portion has a retaining surface configured to be retained by a retaining portion of a device adapted to receive the battery inserted thereinto, and the retaining surface being set to a level lower than a back surface of the frame portion.

3. The battery according to claim **2**, wherein the retaining surface has a frictional coefficient smaller than that of a portion of the frame portion other than the retaining surface.

4. The battery according to claim **2**, wherein the retaining surface includes an inclined surface acutely inclined with respect to the frame portion.

5. The battery according to claim **1**, further comprising:
- a third projecting portion projecting in an insertion direction at a first end of the first surface; and
- a fourth projecting portion projecting in the insertion direction at a second end of the first surface.

6. The battery according to claim **5**, wherein the third and fourth projecting portions have different shapes from one another.

7. The battery according to claim **1**, wherein the battery has an almost square main surface located in a plane perpendicular to the frame portion, the first side surface, the second side surface, and the first surface.

8. A battery comprising:
- a back frame portion having a back surface and a thickness extending towards an insertion surface of the battery, the back surface also having a width;
- a first projecting portion being within the width of the back surface and being within the thickness of the back frame portion; and
- a second projecting portion being within the width of the back surface and being within the thickness of the back frame portion,
- wherein the first projecting portion extends from a first longitudinal end of the back frame portion and has a first shape, and
- wherein the second projecting portion extends from a second longitudinal end of the back frame portion and has a second shape different from the first shape.

9. The battery according to claim **8**, wherein the first projecting portion has a to-be-retained surface retained by a retaining portion of a device adapted to receive the battery inserted thereinto, and the to-be-retained surface is set to a level lower than the back surface.

10. The battery according to claim **9**, wherein the to-be-retained surface has a frictional coefficient smaller than that of a portion of the back frame portion other than the to-be-retained surface.

11. The battery according to claim **10**, wherein the first projecting portion having the to-be-retained surface has an inclined surface acutely inclined with respect to the back frame portion.

12. The battery according to claim **8**, further comprising a plurality of projecting portions having different shapes from one another and projecting in an insertion direction at both end portions of the insertion surface.

13. An electronic device having a battery insertion portion configured to receive a battery,
- wherein the battery comprises a back frame portion having a thickness extending towards an insertion surface of the battery and a first side surface connected to and substantially perpendicular to the back frame portion,
- the back frame portion further comprising a first projecting portion and a second projecting portion having different shapes from one another located at both longitudinal ends of the back frame portion and being within the thickness of the back frame portion,
- the first and second projecting portions being located in a plane substantially perpendicular to the first side surface,
- the back frame portion being opposite to the insertion surface of the battery inserted into the electronic device, whereby the battery formed in the flat almost rectangular parallelepipedic shape and having an almost-square main surface is prevented from being erroneously inserted into the electronic device.

14. The electronic device according to claim **13**, wherein:
- the electronic device includes a retaining portion configured to retain the battery;
- the first projecting portion having a to-be-retained surface retained by the retaining portion; and
- the to-be-retained surface is set to a level different than the back frame portion.

15. The electronic device according to claim 14,
wherein the to-be-retained surface is a surface having a frictional coefficient smaller than that of a portion of the back frame portion other than the to-be-retained surface.

16. The electronic device according to claim 15,
wherein the to-be-retained surface has an inclined surface acutely inclined with respect to the back frame portion, and configured to accelerate unloading of the battery from the electronic device by the inclined surface undergoing contact pressure of the retaining portion when the battery is unloaded from the electronic device.

17. The electronic device according to claim 13,
wherein the electronic device is formed with a notched portion which is adapted to receive and expose the second projecting portion at the time of loading the battery, thereby facilitating unloading of the battery.

18. The electronic device according to claim 13,
wherein the battery further comprises third and fourth projecting portions having different shapes from one another and projecting in an insertion direction from both end portions of the insertion surface.

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